ELECTRICAL REVIEW

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ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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The American Fire Alarm and Police Telegraph.—(*Continued.*)

In the improved non-interference signal box, the clock-work is inclosed in a dust-tight, cast iron, round box, which is placed in one corner of a square iron case having a hinged door and lock, with key under the exclusive control of such city officers as may be authorized or required to give special signals. This case contains, in addition to the round box, a lightning arrester, also a telegraph key and call bell for engineers or police signals; thus every signal station may be used as a telegraph office for any city purposes. A small starting lever, spread into a thumb-piece or hook on the outside, passes through the door of the case, and projects through a closely-fitting aperture into the round box, where its end rests immediately under the detent lever of the signal mechanism. Lifting the detent lever, by pressing the starting lever lightly downward once, sets the

FIG. 5.

signal mechanism, and through it the whole system of fire telegraph, in operation. The outside boxes are locked with combination locks, the keys of which are placed in the hands of the police and one or more responsible property holders in the immediate vicinity of each box. It will thus be seen that the mechanism is secured inside of the inner of three distinct iron boxes, and that opening the outer door reveals nothing but a square iron case with a thumb-piece projecting from its door.

So perfect is this mechanism that it is utterly impossible for any other than the correct signals to be transmitted, and when once started it can in no way be interfered with, not even by the pulling of another box, until it has performed its entire work. (See Figs. 6 and 7.)

The Plain Pony is the simplest and lowest-priced signal box, suitable for small cities and towns, where they wish protection for the smallest amount of money. A view of this box is shown with the outside door open in Fig. 8.

The Sector non-interference signal box, as exhibited in Figs. 9 and 10, is the style of box adopted by the city of Philadelphia. These Sector boxes may be made to run with either weight or spring. The distinguishing feature between them and the regular non-interference boxes is that these, as will be seen by the engraving, have a much longer pull, and are wound by the pull at each alarm of fire; while the regular boxes are wound up like a clock, and need but the slightest touch of a finger to set them in action.

All the alarm-apparatus is termed *electro-mechanical;* for a very important and distinguishable feature of it is, that it requires but a *minimum* amount of battery-power to control an unlimited amount of mechanical force.

FIG. 6.

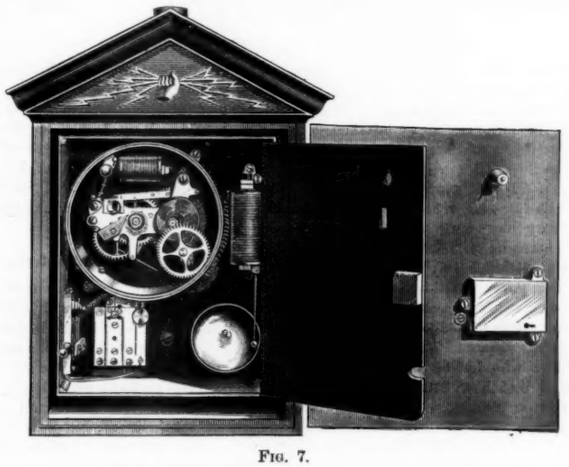

FIG. 7.

Electro-mechanical tapper, shown in Fig. 11, has a 6-inch bell, struck with considerable force; makes a very neat and reliable apparatus to be placed in bed-chambers, offices, or even in engine-houses where there is not a great deal of noise to distract attention.

The "Excelsior" gong, shown in Fig. 12, is made with three sizes of bell—8-inch, 15-inch, and 18-inch. This gong is by far the most reliable and efficient signal-gong for sounding a definite number of blows. It is almost impossible that it should fail to respond to every break of its circuit, and it never gives "double blows."

The indicator seen in Fig. 13, with an 8-inch mechanical vibrating gong set in motion by the first movement of the indicator, is also made without the vibrating gong. These indicators display any number from one to nine hundred and ninety-nine, and are not mere indications of what a gong or bell may strike.

The instrument represented in Fig. 14 consists of an indicator combined with the 8-inch, 15-inch, or 18 inch Excelsior gong, each with its own magnet, and acting entirely independent of each other, so that if the gong should accidentally miss a blow, the indicator will not fail to make the right record.

The bell striker, for church or tower bells, is shown in Fig. 15. Wherever call-men are in any way relied on for a fire department, it is absolutely essential that general alarms should be sounded, in cases of fire, upon large bells. The machines furnished for this purpose to give the full tone of the heaviest bells, or sound alarms by steam whistles.

It is not necessary that bells should be specially provided for fire-alarm purposes, as bell-strikers can be attached, and used with any school or church bell without in any way interfering with their ordinary use.

Suppose a fire breaks out in a city where the automatic system of fire telegraph is in use. The party who first discovers the fire runs to the nearest signal-box, and obtaining a key opens the outer door of the box, and pulls down the brass hook, which is plainly in sight, once only, and lets go. Before he can turn his back upon the box, its clock-work is in motion, and an alarm is being sounded upon the little bells in every signal box, the gongs in the engine-houses, and upon the large tower-bells. Suppose the hook of box 21 has been pulled, the blows upon the bells and gongs will be given thus: 1-1 (two blows), then a pause of five or six seconds, and then 1, making 21; and this is repeated four times.

The executive offices of the Gamewell Fire-Alarm Telegraph Company are at 1½ Barclay Street, New York. Its officers are Joseph W. Stover, President; Chester H. Pond, First Vice-President and Secretary; Joseph Kinsey, Second Vice President; Otis

FIG. 8.

T. Petter, Treasurer, and John N. Gamewell, General Superintendent. Messrs. Wm. H. Mendell and James M. Gardner are special agents; and the company also has the following local agents: E. B. Chandler, 118 La Salle Street, Chicago, Ill.; The Bell Telephone Company of Canada, Montreal, P. Q., Can.; Edwin Rogers, 115 Congress Street, Boston, Mass.; The Utica Fire-Alarm Telegraph Company, Utica, N. Y.; Post & Co., Cincinnati, O.; Webb Chandlee, Richmond, Ind.; J. Frank Morrison, 7 South Street, Baltimore, Md.; B. R. Bates, Denver, Col.; California Electrical Works, 34 Market Street, San Francisco, Cal.

A Government Conference of Electricians.

A bill is pending in the House of Representatives for the appointment of a Government Commission to conduct a national conference of electricians and make special investigation on the occasion of the International Electrical Exhibition to be held in Philadelphia next September. The bill was introduced into the House in January last by the Hon. William Mutchler, of the Northampton District, in this State, was referred to the Committee on Commerce, and has been unanimously agreed to by that committee. It is a measure that deserves the approval of Congress, for no physical science, chemistry perhaps excepted, comes home so closely to the affairs of every-day

life in these days as that which relates to the laws, phenomena and applications of electricity. We, of course, get most experience of it by means of the telegraph and the electric light, but these are only two of its many uses. It is equally valuable in the chemist's laboratory and in many workshops. It is in the hands of the scientific investigator as an aid in his researches which he cannot do without. It is in the hands of Government officers as an indispensable instrumentality for the guidance and explosion of the most formidable engines of destruction in all warfare. It comes to the aid of the quarryman when he has to throw down an enormous cliff. It enables General Newton and his successor engaged in removing the rocks which obstruct navigation at Hell Gate, in New York harbor, to carry on their work under the water. It places in the hands of the astronomer the ability to work time among the celestial bodies to the hundredth part of a second. It drives the sewing machine needle and the lathe of the artisan; and it enters into the composition and economy of so many other things that the catalogue of the coming Franklin Institute Exhibition extends into scores of classifications and hundreds—perhaps thousands—of objects. It is on our own streets, in our houses, workshops, laboratories and ships, and we all have need to know more about it.

Electricity is one of the few energies that are carrying on the physical activities of this world at a faster gait than ever moved before; and the science of it—that is, its nature and the laws by which it works and may be controlled for the uses of man—is a subject in the highest degree entitled to the encouraging action of the Government. Congress is not asked now for the first time to pass laws for the advancement of science and the diffusion of useful knowledge, and to provide for such objects. It has done so for many years in the Naval Observatory, which is equipped with one of the largest and best refracting telescopes in the world, and which, until quite recently, was the very largest and best. This is in aid of the Nautical Almanac, for the benefit of our own and the world's commerce on the high seas. It has encouraged the Coast Survey to make scientific examinations far beyond the immediate scope of a hydrographic survey of our coasts and inland waters. It has sent out expeditions to sound and explore the profound depths of the Atlantic and Pacific Oceans; to take observations of solar eclipses and transits of Venus in distant countries. It is ahead of all the world in its contributions to the applied science of meteorology, and pursues that useful work, at large annual expense. It was engaged for several years in elaborate scientific inquiries into the composition of iron and steel and their resisting strength when subjected to strains of work in which it was aided by the Franklin Institute.

The foregoing list of the scientific works which Congress has authorized the Government to undertake or assist, is called up from unaided memory. It could easily be enlarged by reference. Useful as such undertakings have been, none of them surpass in importance the investigations and results within probable reach of the Electrical Commission provided for in the bill before the House, which gives occasion for these remarks; and some of them bear no comparison in the matter of immediate practical usefulness. While the application of electricity to commerce and the arts is making enormous strides, the science itself as a science—that is sure knowledge of the laws which govern that invisible and imponderable agent known as electricity—is in its infancy. It is the subject of eager, diligent patient research. Those who know most—those who handle it, so to speak—understand best how little they really do know of those laws, or what is the nature of the influence that excites or causes fluctuations or obstructions in the thing which for convenience of conversation is called an "electric current," but which they know is not a "current" at all. What else it may be they know not, in any way that can be described in form of words.

A vast field of the unknown is open to research; and one of the very best opportunities for aiding in it with practical effect will be at the Franklin Institute International Exhibition this coming autumn, for here there will be gathered at that time not only an immense display of the objects by means of which electricity is made to do helpful work for man, but here will also be at the same time the American Association for the Advancement of Science and the British Association. It will be a world's congress of the men of science who speak in our own tongue.

FIG. 10.

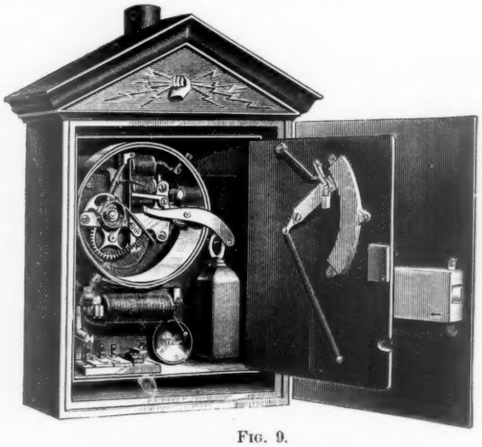

FIG. 9.

FIG. 12.

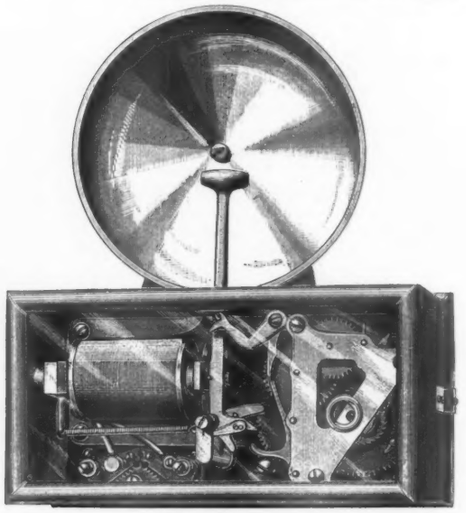

FIG. 11.

The bill that provides for the American Commission (House bill No. 2,655) is, therefore, one of the bills Congress should pass; and it would greatly help if it should be passed at an early day, so as to give the president an opportunity to select the ablest electricians—men versed in both the theory and the practice—the country can supply.

A National Electrical Conference.

One of the most important movements inaugurated in connection with the International Electrical Exhibition is that proposed by the passage of the following bill now pending before the House of Representatives. The project is not only supported by the foremost men in electrical and physical science of this country, but it is regarded with favor by all who comprehend the immense developments possible to electricity—under the impulse of conferences and investigations such as the proposed Government Commission can undertake. The measure was advocated before the Commerce Committee of the House by Professor M. B. Snyder, chairman of the Committee on Conferences of the Franklin Institute, and professor of astronomy in the Central High School of Philadelphia; Professor H. A. Rowland, professor of physics in the Johns Hopkins University, Baltimore; Professor Simon Newcomb, superintendent of the Nautical Almanac Office at Washington; Professor C. F. Brackett, professor of physics in the college of New Jersey, at Princeton; Professor C. A. Young, director of the Holstead Astronomical Observatory at Princeton; and was also supported by other well known scientific gentlemen. The bill, as here given, has been favorably reported to the House and referred to the committee of the whole.

MR. MUTCHLER INTRODUCED THE FOLLOWING BILL:

48TH CONGRESS, 1st Session. } H. R. 2,655.

[Report No. 1,444.]

IN THE HOUSE OF REPRESENTATIVES, January 8, 1884; read twice, referred to the Committee on Commerce, and ordered to be printed.

May 7, 1884.—Reported with an amendment, committed to the Committee of the Whole House on the State of the Union, and ordered to be printed.

A BILL to authorize the appointment of a scientific commission which may conduct a national conference of electricians and special investigations on the occasion of the International Electrical Exhibition, to be held in Philadelphia in eighteen hundred and eighty-four:

Whereas, the interests of electrical science and the rapidly increasing use of electricity in this country demand the official assemblage of a national conference of electricians, which may not only consider scientific questions of public importance, but also create a stimulus to more extended and intelligent application; and,

Whereas, the International Electrical Exhibition, to be held in Philadelphia in the autumn of eighteen hundred and eighty-four, under the auspices of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, offers a rare and fitting opportunity for such an official assemblage of electricians: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States be, and is hereby authorized to appoint a scientific commission, which may, in the name of the United States Government, conduct a national conference of electricians in Philadelphia, in the autumn of eighteen hundred and eighty-four.

Sec. 2. That said commission may invite scientific men, native and foreign, to participate in the conference, and may in general determine the scope and character of its work. The commission may also conduct such special investigations, both at and subsequent to the International Electrical Exhibition, as may conduce to the progress of electrical science in this country, and may prepare and submit reports of the results of the conference and investigations.

Sec. 3. That the sum of twenty-five thousand dollars be appropriated to meet the expenses of the commission in conducting the conference and investigations, and to meet the expenses of preparing reports of the same: Provided, That the whole amount of the expense incurred by said commission shall not exceed the said sum of twenty-five thou-

sand dollars; and the members of said commission shall not receive any compensation for services.

Sec. 4. That the work of the commission shall be completed within three years of the passage of this act; and that any balance remaining unexpended at the expiration of that time shall be covered into the United States Treasury.

On the Absolute Standard of Light.

The study of the radiation emitted by melted silver has essentially for its object the verification of the principle of the method which consists in taking as standard the light of a metal at its point of fusion, following the idea which I put forward at the International Congress of Electricians in 1881.

Preliminary researches having shown the constancy of the radiation during the whole time of solidification, I was enabled to take in hand with safety the realization of the absolute standard.

I take, as an absolute unit of light, the radiation emitted by a surface of one square centimeter of platinum at its point of solidification.

FIG. 13.

To obtain any given multiple of the unit it is merely requisite to increase the surface.

The Carcel lamp, of Dumas and Regnault's model, having been adopted as a usual secondary standard, I have been obliged, in the first place, to determine the value of this lamp in relation to my type-standard. By means of different methods, which gave accordant results, I found for the value of the normal Carcel lamp, c,

$$c = \frac{1}{2.08};$$

whence, taking the surfaces into account, it may be concluded that the intrinsic intensity of our standard is, approximately, eleven times that of the Carcel lamp.

I have also operated upon electric foci. The comparison with the standard has been found practically very satisfactory. I describe merely the experiments made with incandescent lamps, the color and the constancy of which render the comparison with platinum very easy and certain.

The incandescent lamp (Swan's system) was supplied by a battery of 30 Kabath's accumulators. A resistance box inserted in the circuit enabled us to vary the arrangement. Every minute an observer noted the intensity, *i*, of the current, and the decline of the potential within the limits of the lamp. It was, therefore, merely requisite to take the instant of each photometric measurement in order to know the corresponding condition of the lamp, and consequently its lighting power; special experiments at the beginning and at the end of each series of observations having determined this power for different values of *i*, E. The relative values of E given below, being deduced from electric measurements, are independent of the possible variations of the Carcel lamp.

In order to compare the electric lamp with the standard, I made use of a Bunsen's photometer, which could be moved between the two sources of light, which were separated from each other by a distance of four meters. The rays emitted vertically by the platinum were thrown horizontally by means of a mirror at 45°, the total effective distance being about 4.50 meters. It was accurately determined each time. We call it Δ, and the distance from the platinum to the photometer D.

At the first sitting three different observers took each six measurements. From the eighteen determinations thus obtained, we may deduce as many values of the expression, $\frac{E\,D^2}{(\Delta - D)^2}$ representing the intensity, in Carcels, of the light reflected by the mirror placed above the platinum. As for the observers, these values are divided in three groups, of which the respective means are:

G	7.018
M	7.016
V	7.035
Mean	7.023

As for the arrangement of the lamp, they are also divided into three groups.

i	*e*	*i* × *e*	E	D	$\frac{D^2}{(\Delta - D)^2}$	$\frac{E\,D^2}{(\Delta - D)^2}$	
0.86	47.7	41.0	1.35	8140	5.177	6.989	(3 exp.)
0.86	47.9	41.2	1.37	8130	5.071	6.947	(2 ")
0.86	48.0	41.3	1.38	8130	5.071	6.998	(2 ")
0.89	49.3	43.9	1.70	8060	4.135	7.029	(3 ")
0.89	49.5	44.6	1.80	2995	3.857	6.943	(2 ")
					Mean		6.986

FIG. 15.

i	*e*	*i* × *e*	E	D	$\frac{D^2}{(\Delta - D)^2}$	$\frac{E\,D^2}{(\Delta - D)^2}$	
0.88	48.2	42.4	1.64	3060	4.275	7.011	(7 exp.)
0.88	48.5	42.7	1.75	3033	4.067	7.066	(3 ")
0.88	48.4	42.6	1.71	3040	4.108	7.023	(3 ")
					Mean		7.023

At a subsequent sitting the arrangement of the lamps was made to vary much more. The second table summarizes the observations.

The photometric measurements agree well with the electric measures. They give for the normal Carcel, $c = \frac{1}{2.07}$, a value very near that which we have found directly.

To sum up, platinum at its melting point fulfils the conditions which we must require from an absolute standard of light: it depends on a physical phenomenon perfectly definite and constant, and, being of a convenient magnitude, it yields a practical term of comparison for the customary standard.—By M. J. VIOLLE, in *Comptes Rendus*.

Purification of Water by Motion.

A discovery has been made by Dr. Pehl, of St. Petersburg, which promises to have a very important bearing on many industrial processes. The water of the river Neva is very free from bacteria, having only about 300 germs in a cubic centimeter. The canals of St. Petersburg, on the contrary, are infected with bacteria, their number reaching 110,000 in a cubic centimeter, even during good weather. The same is true with regard to the conduits of water for the supply of the city. While the chemical composition of the water passing through these city conduits hardly differs from that of the Neva (by which they are supplied), the number of bacteria reaches 70,000, against 300 in the water freely taken from the river; and the worst water was found in the chief conduit, although all details of its construction are the same as in the secondary conduits. Dr. Pehl explains this anomaly by the rapidity of the motion of the water, and he has made direct experiments in order to ascertain that. In fact, when water was brought into rapid motion for an hour, by means of the centrifugal machine, the number of developing germs was reduced by 90 per cent. Further experiments will show if this destruction of germs is due to the motion of the mass of water, or to molecular motion. If this discovery of Dr. Pehl's be confirmed, it will become possible to destroy bacteria, and render a water comparatively pure simply by passing it through a centrifugal machine. The subject is of special interest to brewers, who suffer, perhaps, more than any other manufacturers from the attacks of bacteria.

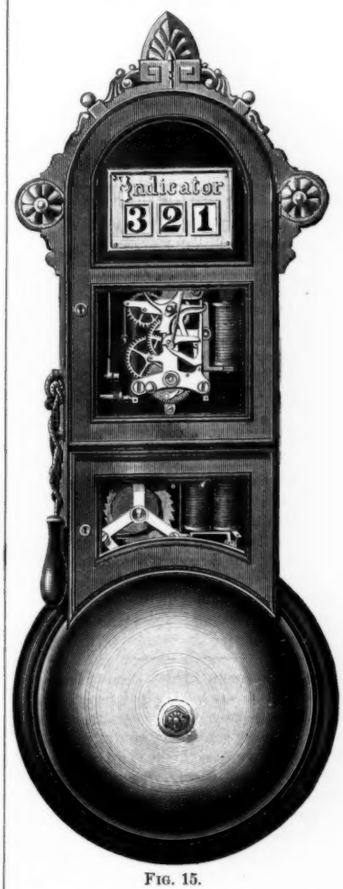

FIG. 15.

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EDITORIAL ANNOUNCEMENT.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, JUNE 14, 1884.

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Bell Telephone stock advanced sharply last week and got back to anti-panic prices. The books show that for the first three months of the present fiscal year the net earnings of the company were at the rate of twenty per cent. per annum, and, as they also show a steady increase of the number of telephones in use, there is every reason to expect a growing rate of net profit during the balance of the year.

The incandescent light is coming into use in England in the coal mines, especially in those that are dangerous on account of gas. In the matter of safety they are fully equal to the best "Davy," and in the matter of illumination they beat it out of sight, since the wire gauge, which is essential to the safety of the Davy lamp, cuts off a very large proportion of the light. There are many mines in this country, especially those in the bituminous seams in Virginia, where the incandescent light might be used to great advantage.

Experimental work continues on the Bell Company's copper circuit between this city and Boston with very satisfactory results. The mere matter of talking over the line between the experimental stations in the two cities is simple enough, but when it comes to connecting the circuit in with the Exchange lines, so that a subscriber in New York may talk direct with a subscriber in Boston, new difficulties present themselves. But these have been overcome, and this week very excellent results of this sort have been obtained.

The multiple-switch board, which, as now made, is a marvel of compactness, has been still further improved by reducing the size of all the parts, so that, for a given number of subscribers, it will occupy just one-half the space now required. We learn that the necessary drawings were completed some time since, and that the Western Electric Company is at work on the new boards. It is probable the Boston Exchange will be equipped with one of them, which will delay removal to their new office until October.

"All work and no play" is poor policy, and with this in mind Messrs. Ingham, Downs & Glidden invited a lot of "the boys" to enjoy the hospitalities of their "Syndicate Farm," near Lowell, Mass., last Wednesday. Telephone interests preponderated, and General Managers were as plenty as Brigadier Generals in Washington when the firing was heavy at the front. There was no end of a good time, for all formality was laid aside, and all acted and felt like boys on a frolic. It should be added that a Jersey wedding was the ostensible object of the gathering.

The famous "Drawbaugh suit" is approaching its end. The evidence is all in, and it is said that the arguments may be looked for in July. They will be looked for with an interest only second to that which the opinion of the court will excite, for both sides have able counsel and both have devoted unlimited time and money to the perfection of their case. As to the outcome, men differ in opinion as much as they did in the case of the great English "Claimant." But we shall all know when the Court has spoken, and the wisest among us will not know until then.

Our paragraph of last week concerning the doings of the Overland Telephone Company in this State has brought us the favor of a reply from Mr. Geo. M. Lowery, one of the directors, in which he repudiates our statement that stock selling is the company's chief object, and adds: "The men who have become directors in this board are not only men of standing and influence, but men of brain and wealth, and have gone into the telephone business as they would into any other legitimate transaction, and propose to stay there until the Supreme Court of the United States says they shall put down their arms."

They are having very much the same trouble in certain parts of London with the overhead wires that they had years ago with the street railways. The control of the streets is vested in the different parishes, and the vestries are the authorities in power. These parishes are divided by imaginary lines, and only the initiated can tell what town they are in at any given moment. Some of the parishes are very liberal, some set up annoying and burdensome conditions, and some, without giving any reasons, prohibit the wires entirely. London vestries are proverbially pig-headed and unreasonable, and the present trouble is a new illustration of the clumsy way in which London is governed.

Some idea of the part that the telegraph is taking and is to take in the future in newspaper work may be judged from the amount of telegraph news that appeared in every daily paper of any importance during convention week. Formerly correspondents were instructed to boil their telegrams down, and to remember that every word cost money, but now their instructions, if one may judge from their acts, must be to send anything and everything. One would think that column upon column of Convention proceedings would be a heavy enough tax on the papers, but to this they add as many more of personal opinions, transcripts of editorials, in whole or in part, of leading papers, and incidents and gossip. Such enterprise "comes high," but it appears to pay.

Our foreign exchanges of the electrical sort have much to say concerning the electrical launch and the measure of success that has attended the experiments that have been made with it in English waters. So far there seems to be a good many "outs," especially in connection with the storage batteries used, and neither the speed, the power, nor the endurance yet attained are such as to encourage any one to follow in the footsteps of English experimenters. The slow and tedious process of charging the accumulators, their loss of power, their great weight, and the small return of power all count heavily against the scheme. That we shall have a reasonably satisfactory electrical launch there can be no reasonable doubt, but that power will be furnished by any of the forms of storage battery now made does not seem probable.

In the matter of underground wires our London namesake has come to very much the same conclusion that was reached by the General Committee of Electricians in this city. It will be remembered that the committee recommended the appointment of a commission by the legislature, with instructions to investigate and report. The *London Electrical Review* says: "Would it not be well, pending any further law-suits and legal decisions on these matters, which may again be upset on appeal, for the Board of Trade, aided by proficient experts, to thoroughly investigate the subject with a view to arriving at an absolute determination? Were this entertained and accomplished in a complete manner, we should, knowing already the principal facts concerning overhead wires, have no difficulty in settling the vexed question in point."

The practical consolidation of the Bankers and Merchants' and the Postal Telegraph Companies is the event of the week in telegraph circles. Some such move was to be looked for as the result of the financial troubles of the President of the Bankers and Merchants. If the rumors that are in the air are to be relied upon, the Baltimore and Ohio stood ready to "take in" the Bankers and Merchants had negotiations failed with the Postal. Prior to this it is quite certain that Jay Gould was approached by the B. & M., but he evidently thought that it was not quite ripe enough to pick, and so allowed it to go elsewhere for a market. We venture the suggestion that the next move will be the consolidation, in some form, of the new combination and the Baltimore and Ohio. It may look like a lion and lamb arrangement, but if the B. & O. plays the minor role the lamb will not be inside.

The time is coming when business houses using the telephone largely will relegate it to a closet, and employ a small boy to answer calls and summon the particular party needed, and, in many cases, to transmit messages. Putting a telephone into an open office, especially in the summer time, when windows have to be kept open and the noises from the street interfere with even ordinary conversation, is to use the instrument unfairly and to terribly try the tempers and patience of those who try to hear the "still small voice" of the operator in the central office. In trying to drown the noise of the street by loud speaking the subscriber does just what makes it most difficult for the person with whom he is talking to hear his words, and he not infrequently attributes the fault to the instrument when the latter is more sinned against than sinning. A combination of closet and small boy will do away with two thirds the annoyance, and aid the central office materially in giving prompt, efficient and satisfactory service.

The citizens of Boston, if one may judge from the communications appearing in the papers there, evidently think that the Committee on Street Lights assumes to own the streets, the public squares and the common. The city government made ample appropriation for an increase in electric lighting, but the committee refuses to use it for that purpose, but, instead, has reduced the number of electric lights by discontinuing those on the common. The fact probably is that the committee is owned, body and soul, by the gas company, and in no city in the country is the gas interest more insolent, arrogant or brazen-faced than in Boston. But it has gone too far this time, and although it may triumph for a time, public sentiment is so decidedly opposed to it that its reign is certain to be brief. That it should oppose the electric light is not surprising, for, in view of the competition, it has been forced to cut down its price materially, but this is no excuse for preventing the execution of the plainly expressed will of the people.

Dr. Tanner, the man that tried to see how long he could exist without food, and unfortunately survived the ordeal, has, for some inscrutable reason, been interviewed on the subject of electricity, and has delivered himself of an opinion as is an opinion. He contends that "the human organism is a machine run by force. That force he assumes to be electricity. He further claims that this subtle motor force is the energizing principle in food; that it is contained also in the water we drink and in the atmosphere we breathe. He assumes also that electricity is the cohesive power that holds all particles of matter together, mineral as well as vegetable and animal. He believes that the time will soon come when the minerals will be utilized for food; that is, this energizing principle in metals will be evolved by manipulations and made subservient for good by supplying man with the most potent of all forces in nature." It may be that Dr. Tanner has a clear idea of the meaning his words are intended to convey. In that case he certainly has us at a disadvantage.

THE ERIE REPORT.

The very full and interesting report of the Directors of the Erie Telephone and Telegraph Company for the first ten months of its existence will be found in full on another page to-day, together with the financial statement of the treasurer and the report of the auditor. It will be seen that the business of the company has been pushed with very great energy and success, that a very large amount of construction and reconstruction has been done during the period covered by the report, that there has been a steady and rapid increase in the number of subscribers, and that the income from extra-territorial lines has grown very rapidly.

In discussing the probabilities for the future the directors institute some comparisons between the territory belonging to their company and that covered by the New England Company which are at once interesting and instructive. They show that as yet the telephone is far from being as largely used in the Erie territory per 1,000 of population as in the New England States, but they also show that the Erie territory is growing in population at an astonishing rate, and that the increase in the use of telephones bears a certain relation to this increase.

It is very clear now, although there were many doubting ones a year ago, that the consolidation of the Southwest, the Northwest and the Erie Companies, all being at the time virtually in the same hands and under the same management, was a wise move. It has materially simplified the organization and the management, and, thus far at least, has worked admirably.

From what we learn from the report itself and from other sources we believe that the business of the Erie, in all of its divisions, but particularly in the Southwest, will grow very rapidly, more so even than the expectations of the directors warrant them in putting forward as probable. The State of Texas is filling up very rapidly with settlers of an excellent class, and there is no little emulation between the different towns as to which can outdo the other in modern improvements. Among these the telephone stands first, and towns which have not introduced it find themselves looked upon as old-fashioned, slow, and unattractive. Then again, the people now seeking homes in the Southwest, especially in Texas, are men of the pushing, energetic kind that believe in using every device that will expedite business. They take more than kindly to the telephone, and very soon learn to depend upon it.

The stockholders of the Erie Company are certainly to be congratulated upon the excellent condition in which their property and business stand at the expiration of the first ten months of their corporate existence, and upon the bright prospect that is before them.

Prof. Hughes explains the phenomena of magnetism by a simple rotation of the particles of iron. He gives a full exposition of his theory in a paper read before the Royal Society, London.

ART ELETROTYPING.

The business success which has attended the manufacture of artistic tiles in this country has been very largely the result of relying wholly upon original designs and steering clear of reproductions entirely. In this way cheap clay has been given a value which has made it command a high price. Reproductions of the antique, or of modern European designs, may be had in any form, in metal, in clay, in leather, in plaster, in papier-mache, or even in compressed wood, but reproductions of the original designs, made by special artists employed by the tile manufacturers, cannot be bought at any price, because they are copyrighted.

There is no reason why the same idea cannot be profitably put into practice in connection with electrotyping. Art electrotyping, in this country, has not been carried on profitably, for the reason, as we believe, that those who have engaged in it have confined themselves to the reproduction of designs which have become hackneyed and commonplace. Beautiful as are Thorwaldsen's "Night and Morning," the public is not ready to buy them in electrotype copper at prices remunerative to those who reproduce them, for the reason that it can get them in any one of half a dozen cheaper materials, and because they have no element of novelty. But if some electrotyper will make a fresh start, as did Mr. Low in the manufacture of art tiles, employ a competent designer and eschew all reproductions, we venture the assertion that he could find an ample market for his wares at prices highly remunerative. Of course, the better the designs, the more "taking" the subjects, the better the prices and the profits. The aim of an electrotyper, embarking in such an enterprise, should be to be satisfied with nothing but the very best in the way of designs, and he should remember, in fixing his prices, that it is not so many pounds of copper that he is selling, but a work of art.

The field for de-ign is limitless, and so too is the number of uses to which art electrotypes may be applied. As separate "pieces," for household adornment, there would be a large demand, while for decorative purposes, in connection with the manufacture of furniture, stoves, and other articles of domestic use, we believe the consumption would grow rapidly. Art tiles have been applied and used in ways never dreamed of until they took a position as *original* works of art, and the number of ways in which art electrotypes could be used is, from the very nature of the material, much larger; for, while copper can be combined in construction with pretty much everything, there are but few materials with which clay may be allied without incongruity.

Electro-plating with copper and brass has been very successfully employed in connection with art castings in iron, and some very pleasing effects have been produced. But they offend that severe canon of art which prescribes that things *shall be* "what they seem." Art electrotypes would be honest, at least, and, if of well-executed designs of well-selected subjects, would be in demand among the very best classes for household adornment.

The contract for lighting the buildings and adjacent grounds of the International Forestry Exhibition to be held in Edinburgh during the months of August and September of the present year, has been secured by the Anglo-American Brush Electric Light Corporation, limited. The plant for lighting the Exhibition will be on hire, and will consist of the following apparatus: Four No. 7 Brush arc machines, working forty-six Brush-Sellon lamps distributed about the interior of the buildings, and fifteen Brush 2,000 candle-power (nominal) arc lamps on the outside of the exhibition buildings and adjacent grounds. As in many parts of the buildings arc lamps would be unsuitable, the corporation are supplying two of their E$_2$ Victoria machines, compound wound, each capable of maintaining 250 20 candle-power 60 volt incandescent lamps.

Kansas City, and Northwestern News.

KANSAS CITY, June 2.—Leavenworth, Kansas, is being reconstructed—that part of it known as the telephone exchange. This city of about 22,000 inhabitants is showing up splendidly as a telephone town, over 350 being in use at the present time and new ones applied for. Having outgrown the present facilities, the Missouri and Kansas Telephone Company decided to make some improvements there, and the poles on the main street are being torn down and larger ones put up instead. Cables of the Patterson make will be used in getting the wires into the operating room. General Superintendent Smith experienced considerable difficulty there at first in locating the new line of poles, as nearly every business house is supplied with a wooden awning extending to the curb. These evidences of rural beginnings are rapidly disappearing in progressive cities of the West, and Levenworth is gradually awakening to this fact. Manager Long, of Levenworth, has been promised a new multiple switch-board by Mr. Smith as soon as he has 400 subscribers, and his excellent management promises to soon make the fulfilling of that promise necessary.

Atchison, Kansas, is also to be reconstructed by the telephone company, larger poles having been recently shipped there for that purpose.

The telephone exchange at Burlingame, Kansas, the property of the United Telephone Company, has been closed, the citizens of that town not having the necessary enterprise to sustain it. A public telephone connected with the surrounding exchanges is all that remains. It is quite likely, however, that Burlingame will yet come to the front and do what the neighboring towns are doing—sustaining lively and business-like telephone exchanges.

The following from the Kansas City *Journal* on the occasion of a heavy hail storm, shows that when telephone men start out to practice jokes it would be well to stand from under:

"During the hail storm a wicked idea seized Manager Price and General Superintendent Smith, of the telephone company, and when some innocent parties were passing along by the Wales building, and wondering at the large hail stones, their surprise was increased by seeing pieces of hail about the size of a young iceberg coming down upon them. The men opened their mouths large enough to swallow several hogsheads of the hail stones, and then stooped over and carefully picked some of them up, probably intending to set up a museum to rival even the baby show. The enormous stones still fell from Heaven, and there was soon quite a crowd eagerly picking them up. But wonders some time cease, and this one did when a sheepish lot of men discovered that they were sold, and perceived some parties way up in the Wales building generously throwing the ice from a water cooler down upon their heads. But when the crowd realized they were sold they threatened to wipe up the floor with the gentleman of the telephone, and it took them some time to change their minds."

W. J. Ferry is a distinguished lawyer of this city and member of the Missiouri Legislature. Yet when he tackles the fiery, untamed telephone he is willing to confess himself, vanquished. Recently he called on the manager of the telephone company and inquired what he could do to his residence telephone to prevent the electricity, during an electric storm, from tinkling his bell, making himself and family nervous. He was shown how by placing a piece of metal over the lightning arrester and thereby connecting the line wire and ground wire outside the bell what he desired could be effected, and, to illustrate, the manager placed his bunch of keys on the bell connecting the two binding posts. He thought this a good scheme, and the next evening had occasion to put it in practice, and his bunch of pocket keys answered the purpose finely. On going to his office the next day, he discovered that he had left his keys somewhere and was unable to get into his desk or his safe. All efforts to telephone to his residence proved unavailing, the operator telling him every time that he could raise no one. At noon in answer to his inquiry if they had been "asleep all forenoon," his family said the telephone bell hadn't rung once, nor had they been able to raise central office. An energetic search then commenced for the lost keys, but all without avail, until the servant happened to remember seeing them on top of the "talking machine on the wall!" Mr. Ferry then remembered where his keys were, and humbly taking them from off the telephone where they had been since the night before, completely shutting out all communication, he rushed down town offering to treat every friend he met. If you want to enjoy a first-class lemonade just say "keys" to Mr. Ferry, or inquire if his telephone has "woke up" yet?

In this city a schedule is furnished every policeman on duty in various parts of the city, so that every half-hour he is near a residence or business house telephone. By this means if the department at headquarters should want to call on any of their men while on their beats, they have only to look at the schedule to know what telephone he is near and then communication is easy. With the entire fire alarm system and the police department depending as much as they do on the telephone of this city, some idea is to be gained of the value attached to the telephone out here. Forty-seven new telephones were put in in this city last month.

Out of the fourteen Patterson cables strung up in this city, all have worked well except one. The chief operator found a "ground" on all the wires in a certain cable, and also the induction from these fifty wires was very noticeable. A lineman went out on ropes examining the cable and found a slight hole in the cable covering half way between two poles, so covered by the suspension wire and saddle that moisture could easily gather and soak in. An effort to remedy this by enlarging the hole and pouring in hot paraffine was not very successful and it became necessary to replace the cable with a new one, which was done on Sunday, so that not a subscriber out of the fifty knew that for about four hours he was disconnected. The telephones that were used on Sunday, such as livery stables, hotels, etc., were brought to the switch-boards by office wire until the work of connecting up the new cable was accomplished. All the subscribers in that fifty were as much delighted with the improvement in their instruments—as they thought—the next morning, as they had been di-pleased with them for nearly a couple of weeks before.

Frank Knight, of the Palmer Wire Company, was in the city a few weeks ago, but was so rushed with business that but few of his friends saw him. His company is gaining an excellent trade in the West.

Paul W. Bassart, a well-known telephone man of the West, now superintendent of the United Telephone Company, has been compelled to take a "lay off" on account of poor health, and left last week for the Catskill Mountains His physicians say that he must go where there is perfect quiet, and this to one of Paul's activity will, no doubt, be very trying. All his numerous friends will wish for his speedy recovery and return.

A manager of a telephone exchange in southern Missouri sent in a voucher reading, "Nigger, setting pole, $1.50." These graphic, clear statements of all the facts in the case are what make Eastern officials smile.

The electric light company of Topeka has recently had a controversy with the mayor of that city, and the present signs indicate that the mayor is ahead and the city in darkness. But the electric light company claims to have a contract that the city will have to come to time on. BI-POLAR.

The *Pall Mall Gazette* is of the opinion that the Underground Telegraph Bill, which passed both houses of the New York Legislature and only awaits the approval of the Governor to become a law, is enough to crush the life out of any business undertaking.

An Electrical Tricycle.

A very clever and most ingeniously constructed tricycle has lately been brought forward by Messrs. Ayrton and Perry, the great peculiarity of which consists in the fact that it is driven, not by the feet, but by electricity, thereby saving all labor. It is described as an open-fronted machine of the usual pattern, but with its ordinary driving gear removed. The driving wheel is 44 inches in diameter, and close to it is a large spur-wheel containing 242 teeth. The motor is placed beneath the seat, and the armature spindle carries a spindle of 12 teeth, gearing of into a spur wheel, by which both motion and speed are regulated. The battery is composed of Faure, Sellon, Volknar cells, and is so placed as to act direct on the spur-wheel, so that there is no loss of power. When fully charged, the battery is said to contain a store of electricity equal to what is understood as two horse-power. The engine is entirely under the control of the rider, and pace can be regulated to a nicety. Such a machine will be found invaluable to invalids, and persons who do not care for driving horses or traveling at a very high rate of speed; and, as neither fire or water is required, there is no fear of explosion, smoke or mess.

At the annual election of the Mexican Telegraph Company, held in this city, on the 3d inst., the following gentlemen were elected directors for the ensuing year:

John A. Alexander, George Blagden, R. B. Minturn, Alfred Pell, James K. Gracie, William G. Hamilton, J. Pierpont Morgan, James A. Scrymser, James J. Higginson.

The net revenue to December 31, 1883, was $132,850.10, from which there should be deducted for dividends and Mexican Government participation $60,702.30, leaving a surplus December 31, 1883, of $72,157.80.

The earnings from January 1 to June 31, 1884, (June being estimated,) were $118,456; operating expenses, $30,000; estimated surplus, July 1, $160,613.80; providing for a dividend, payable in August, of $57,376, the balance, $103,237.80 being carried to reserve. The company has no debt.

The annual election of the Central and South American Telephone Company, was held on the 3rd inst, and the following were chosen directors for 1884: Ed. D. Adams, M.. P. Grace, Wm. G. Hamilton, Charles Lanier, J. Pierpont Morgan, Alfred Pell, Theo. Disabla, James A. Scrymser, R. W. Thompson. The earnings of the company, amounting to $265,382, have been used to pay its construction account. It is estimated that by August 1 the company will have paid off $301,000 of debt with its net earnings, leaving 9,934 shares of stock in its treasury, and no debt. From January 1 to June 1 the earning were $149,556, an increase of $83,386. The operating expenses were $48,000.

A certificate of incorporation has been filed in the New York County Clerk's office of a company for the purpose of constructing and operating lines of telegraph within the State of New York, the name to be "The Utica District Telegraph Company." The general route is to be from New York City to Utica, and the capital stock is placed at $50,000 in 5,000 shares of the value of $10 each. The privilege is reserved to increase the capital to $100,000. The shareholders mentioned in the certificate are C. D. Haines, of Brooklyn, 2,000 shares; E. T. Haines, of Brooklyn, 2,000; S. H. Sterns, of New York City, 1,000 shares. The period for which the incorporation is drawn is from May 26, 1884, to May 26, 1983. The central office is to be in New York City.

Telephonic News

*** A new telephone insulator has been invented by J. W. Tringham, of Windsor, Ont., and is now being experimented with there.

*** The Swiss telephone companies are rapidly extending their business at Geneva. The exchange has 560 subscribers; Berne, 346; Basle, 420. They use the Bell receivers and Blake transmitters.

*** The following troubles are reported in the Argentine Republic: The telephone has been very eagerly welcomed in Puerto Alegro, S. A., about eighty firms being already connected with the Central Exchange. Since March 1 night service has been introduced, which is a great improvement. Unfortunately, formidable enemies to the regular working of the telephone have been discovered, of which nobody may have thought when the lines were erected. These are the vultures. They usually fly close over the house tops, and often get caught in the wires. Their struggles often place several wires in connection with each other, which causes great confusion to the subscribers. A number of workmen are always engaged in separating the wires again. As soon as one part is put right, the confusion breaks out elsewhere. The worst of the matter is that there is no remedy. The law provides that no vultures may be killed They multiply, and so do telephone lines. Perhaps the vultures will in time get tired of struggling with the wires, and will take to flying higher.

*** The London *Electrician* says, that if there be a primary circuit comprising a microphone, a Leclanche battery of, say, three cells and the primary wire of an induction coil, and a secondary circuit comprising the secondary wire of such coil, another Leclanche battery of, say, 12 cells, and two metal contact pieces, such as are used for medical purposes, and if two persons each hold a contact piece in one hand, and one of them lays his disengaged and gloved hand on the ear of the other, the latter will hear words that are spoken into the microphone, as if they came out of the other's hand. At a recent meeting of the French Physical Society, M. Hospitalier modified the above experiment by replacing the gloved hand by a piece of ordinary paper. Two persons took hold of the contact pieces as before, and placed their heads together ear to ear, with the paper between, and could hear all that was said at the microphone, Further, holding the contact pieces as before, these two laid their disengaged hands on the ears of a third person, who again heard what was spoken into the microphone, the hands appearing to talk.

*** Three years ago, when the telephone was first introduced into Melbourne, Australia, very few persons would have been bold enough to hazard a prophecy that it would soon become one of the most important institutions of the city. Indeed, at that time, so little faith was reposed in it by speculative business men that the projectors of the Telephone Exchange Company had some difficulty in inducing capitalists to touch their undertaking. As time went on, however, a deep and general interest in the novelty began to take the place of apathy; it was seen that the instrument must soon become a great business engine, and the telephone was at last proclaimed a necessity of commercial life. The present number of subscribers to the exchange is 730, and is constantly increasing. The central office has been found too small for the business which has to be done, and removal has become necessary. An entirely new building has been built in William street, and is now occupied. Improved switching apparatus is to be employed from the manufactory of the Western Electric Company of Chicago; and Mr. James C. Warner, electrician to the Western Company, was engaged by the Melbourne Telephone Exchange Company to fit up the new premises.

Annual Meeting of the Erie Telegraph and Telephone Company.

ALBANY, N. Y., June 9, 1884.—The stockholders of the Erie Telegraph and Telephone Company held their annual meeting at 444 Broadway at ten o'clock this morning. The stock was largely represented. President Wm. A. Ingham, of Lowell, Mass., presided. The treasurer presented his report, which was adopted, as follows:

THE ERIE TELEGRAPH AND TELEPHONE COMPANY—STATEMENT OF EARNINGS AND EXPENSES, TEN MONTHS ENDING MARCH 31ST, 1884.

Earnings.

Agency	$8,243 50	
Exchange	371,200 26	
Extra territorial	26,406 42	
Messenger	63 40	
Miscellaneous	16,484 44	
Telegraph commissions	429 03	
Toll line	5,104 33	
		$427,931 38

Expenses.

General expenses	$1,707 05	
Instrument rental	78,530 87	
Interest	1,887 05	
Operating	84,117 72	
Repairs and maintenance	28,039 27	
		194,282 57
Net earnings		$233,647 81

AUDITOR'S STATEMENT.

To Wm. A. Ingham, Esq., President, the Erie Telegraph and Telephone Company:

I have examined the books and accounts of the Erie Telegraph and Telephone Company for the quarter ending March 31st, 1884 I find proper vouchers for all expenditures duly entered to their appropriate accounts, including pay-rolls, supply and expense bills. The ledger accounts have been compared with the journal and cash-book, and the stock ledger and cash have been verified to the date of examination. I also find statement signed by A. G. Poliard and H. B. Shattuck, auditors, covering the examination of accounts from the time of formation of the Erie Company to the commencement of my examination. I have made a balance sheet, which accompanies this report, showing the condition of the company at this date, which verifies the annual report of the treasurer.

W. P. LAMSON, Auditor.

Dividends paid		$172,250 00

STATEMENT OF ASSETS AND LIABILITIES—MARCH 31, 1884.

Assets.

Plant	$2,350,000 00	
License	2,342,965 97	
New construction	339,619 49	
Treasury stock	200,000 00	
Supplies	26,211 32	
Accounts receivable	11,478 81	
Cash	9,157 79	
		$5,279,433 38

Liabilities.

Capital stock	$5,000,000 00	
Surplus	61,398 81	
Advance rental account	21,884 46	
Accounts payable	196,150 11	
		$5,279,433 38

Net gain of subscribers for 10 months, 3,203.

Total number of subscribers connected March 31st, 1884, 8,942.

Number of miles of extra territorial lines built and purchased, 3,143.

CHAS. J. GLIDDEN,
Treasurer.

Albany, N. Y., June 9, 1884.

The directors' report, as follows, was read and adopted:

The Erie Telegraph and Telephone Company is made up of three divisions, situated in quite widely separated sections of the country, the Cleveland division consisting of the city of Cleveland and county of Cuyahoga, Ohio; the Northwest division, comprising the State of Minnesota, the territory of Dakota, and three counties in the State of Wisconsin; the Southwest division, including the States of Texas and Arkansas. In the month of June, 1883, these divisions were being operated as separate and independent companies, with the executive offices at Lowell, Mass., but substantially the same officers were managing them all, and the ownership of the stock was very largely identical in all the companies. Consolidation of telephone companies seemed to be the order of the day, and very strong arguments were used in favor of it; the only objection that was urged in this case was the fact that the different companies which were to be brought together did not occupy contiguous territories. To the parties interested this did not seem to be an insuperable objection, and a submission of the matter to the stockholders of the various companies showed a nearly unanimous vote in favor of the union. The result of this action was the formation of the present company, under the laws of the State of New York, in the month of June, 1883, and the union of the three companies under it. Notwithstanding some adverse criticism upon the consolidation of such widely separated territories, your directors, after ten months of experience and management of the company, believe that the action was a wise one, and that it has resulted in great benefit and advantage.

Since the consolidation, the company has purchased the Southeastern Dakota Telephone Company, and also the Arkansas Telegraph Company, and the revenues have been materially increased from these two sources.

A large amount of money has been spent in improving and extending the plant. At the time of the consolidation the Northwest division was generally in rather a bad condition. With the exception of a few good pole lines in Minneapolis and St. Paul, the construction was very poor. We immediately commenced a thorough overhauling and rebuilding of the lines, which was substantially completed last Fall, and the plants at St. Paul and Minneapolis, with connecting pole lines between the two cities, are now second to none in the country. Cables have been hung in both these places; nearly every street has its pole line, and the division, as a whole, is in a most satisfactory condition throughout. An excellent line of about 120 miles has been built from St. Paul to Winona, connecting these exchanges with Redwing, Hastings, and Faribault—at which places we have exchanges—as well as other intermediate cities and towns. About sixty or seventy miles of trunk lines have been built, connecting various other places in this division.

In the Southwest, with two or three exceptions, the condition of the plant was excellent. The construction was good, and there was an entire absence of house-top lines The business was really commenced in this section in 1881 and 1882, so that at the time of consolidation the construction was nearly new. The few exceptions were exchanges which were started earlier, and these have been entirely rebuilt. A great amount of work has been done in this division in acquiring and building extra territorial lines, 2,897 miles having been added in this way since last June. Many principal cities and towns are so far apart that telephone connection is impracticable; but, notwithstanding this fact, we have increased the extra territorial earnings from $800 in June, 1883, to $3,800 in March, 1884, and we shall get a steady increase in the future.

We are now negotiating with the Sunset Telegraph Company, in Texas, for their lines (some 900 miles of wire), which, if we obtain, will give us all the extra territorial lines needed for the present; otherwise 150 to 200 miles ought to be built in the near future.

Throughout the Northwest and Southwest, with one or two exceptions, the exchanges are in excellent condition, and with good switching arrangements and room for growth. In the Cleveland exchange, while the service is good, the switches are of the old pattern, and it requires more help to operate them than it would with improved boards. We have three branch exchanges, but with new switches in the central office; one of these branch offices could be closed, and quite a saving in rent and operating expense could be made. Improvements in this exchange are under consideration by your directors.

As a whole, the property of the various divisions is in excellent condition. Nearly the entire system is on poles, and what few house-top lines we have give us no trouble, and we are in a condition to vacate them at any time. All new work has been done in a most thorough manner, and the best material and the most approved appliances have in all cases been used.

The increase of subscribers for ten months—the period covered by this report—has been most satisfactory, and has exceeded the highest expectations of your directors. The figures are as follows:

Number of subscribers connected March 31, 1884	8,942
Number of subscribers connected June 1, 1883	5,739
Increase in ten months	3,203
Deduct number acquired by purchase in Northwest	318
Net increase	2,885

It will thus be seen that, aside from those acquired by purchase, the natural growth of your company in ten months has been 2,885 subscribers, or an average of 288½ per month. This increase is distributed among the divisions as follows:

	JUNE, 1883.	MARCH, 1884.	INCREASE.
Northwest	1,842	2,488	646
Southwest	2,467	4,215	1,748
Cleveland	1,430	1,921	491
	5,739	8,624	2,885

Thus it will be seen that the Southwest has increased about seventy per cent in subscribers; the Northwest has increased about thirty-five per cent., and Cleveland has increased about thirty-three per cent.

The increase of subscribers in the territory as a whole has been about 50 per cent., exclusive of the 318 acquired by purchase.

The increase of extra territorial earnings has been still more satisfactory. In the month of June, 1883, the earnings from this source, in all the divisions, were $993.78; in March, 1884, the earnings from the same source were $4,070.88. Your directors believe that in the future the increase of earnings from this source will fully keep pace with the increase of exchange subscribers.

The question, What will the future growth of the company probably be? is one which has undoubtedly obtruded itself upon the mind of almost every stockholder. In answer to this question, of course nothing can be said with absolute certainty, but there are some facts which may furnish a reasonably safe ground from which to estimate the future:

First—What is the highest telephonic development that may reasonably be expected—that is to say, taking one city with another, how many telephones will a given population use, and what is the maximum development in the oldest telephonic territories?

Second—Has the Erie territory reached this maximum?

Third—What will the increase in population in the territory probably be?

If we can answer these questions with an approximation to the truth, we can give an estimate of the future growth of your business.

1. The territory operated by the New England Telephone and Telegraph Company contains some of the oldest telephonic territory in the country, and while the development there has undoubtedly not reached its maximum, it may safely be used for purposes of comparison. Taking twelve of the principal cities in their territory, we find that the proportion is one telephone to every eighty-three of population.

2. Taking twelve of the principal cities in the Erie territory, and estimating the population from the most reliable data at hand, we find that the proportion is one telephone to about 105 of population; in other words, suppose the population of the Erie territory to remain stationary, and it will call for

about 25 per cent. more telephone than it now has in order to equal the proportion in the New England cities. Our experience so far with the cities and towns in the Erie territory, leads us to fully believe that, while the extra territorial line business will not be so good as in New England, on account of the great distance between the cities and towns, the demand for telephone exchange service there in proportion to the population, will be fully equal to that in the older cities and towns in New England.

3. What will the increase of population probably be in the Erie territory? From 1870 to 1880 the population of Maine, New Hampshire, Vermont and Massachusetts increased about eight per cent. During the same period, the increase of population in Erie territory was about ninety per cent., or more than eleven times greater than in the older States. That this territory has not reached a stationary period in population, but will increase very rapidly for many years to come, we believe to be a matter of common knowledge and belief.

We have dwelt thus at length upon this matter because we believe that the facts and figures given will be of great interest to the stockholders, and should always be taken into account in estimating the present value of your property. In closing this part of the report, bearing in mind what the growth for the past ten months has been and estimating the future as safely as we can from the facts above given, your directors believe that the increase of your business for the next few years will be limited only by the capacity of the company to furnish money for construction.

We have experienced no unfriendly legislation so far, and our relations with city and town authorities, with one or two exceptions, have been pleasant. In the city of Sioux Falls, in the Northwest division, the authorities, for some reason best known to themselves, ordered the removal of our lines from several of the principal streets, with an intimation that if they were not removed immediately, the city marshal would be ordered to cut them down. Believing that we had some rights in the streets, and that it might be well to ascertain at sometime what they were, we applied to the courts and obtained a temporary injunction against the city authorities, directing them not to interfere with our property until the matter could be fully heard. This order was disregarded, and the poles were cut down by the city marshal and his assistants. Upon a full hearing, the city marshal and all other parties who had a hand in it, were fined for contempt of court, and the injunction was made permanent, thus entirely vindicating the position we had taken in the matter.

As will be seen by the treasurer's report submitted herewith, the present debt of the company is $196,150.11; deducting the amount of supplies and cash on hand, the net debt is $160,781.00, and there remains in the treasury undisposed of 2,000 shares of stock. At the time of consolidation, there was in the treasury in cash $101,336.72. It was the intention of your directors to sell the treasury stock for construction purposes as needed, and could this have been done at a fair price, a construction fund would have been provided, and your debt would have been merely nominal. But this was found impracticable, and the construction has been carried on for the last six months partly from the earnings and partly from borrowed money. When the treasury funds were exhausted, the question was considered whether the dividends should be stopped until the earnings had increased sufficiently to provide money for construction, in addition to the running expenses and the usual dividend of one per cent. quarterly, or whether loans should be made for that purpose from time to time.

Had the expected future growth of business been less, we should have advised a suspension of dividends for a time, but bearing in mind the fact that we were working a comparatively new territory, and, that judging by the past, the increase of the earnings in a short time not only provide a construction fund in addition to the running expenses and dividends, but would also soon begin to reduce any debt we might create, we believe it to be a safe course to continue the dividends. So far the result has justified our expectations, and should the growth for the next few months equal our estimates, the time is not far distant when the company will not increase the amount of its debt, but will gradually reduce it.

The construction account for the ten months has been larger than any equal period in the future will require. In the opinion of your directors this was called for by the following circumstances:

1. As before stated, some of the older exchanges in the Southwest were in bad condition and have been entirely rebuilt, while the construction of the plant in the Northwest, and to some extend in the Southwest, was such as to render necessary an entire overhauling, and the outlay of a large amount of money to put it into shape to accommodate the future growth.

2. At the time of consolidation the Erie territory was almost entirely without extra territorial lines, the whole amount of your income from this source for the month of June, 1883, having been only about $1,000. The plant in the Northwest and Southwest divisions, with the exception of St. Paul and Minneapolis, consisting of isolated exchanges with no communication with each other, it was absolutely necesary for the healthy growth of the business that, wherever practicable, subscribers of different exchanges should be given communication with each other, although each individual connecting line which was built might not show a large income on its cost. This ground is now pretty well covered. 3,143 miles of extra territorial line have been built or acquired, and the money required in the future will be very much less, and can be spent so as to show a larger return. When it is considered, however, that the extra territorial business has been increased from $1,000 per month to $4,070.88 in ten months, and that the exchange subscribers have increased in the same time about fifty per cent., your directors believe that the liberal outlay has produced a satisfactory return.

For the month of July, 1883, the gross receipts were $31,008.92; running expenses for the same month, $20,921.29. For the month of March, 1884, the gross receipts were $44,085.87; running expenses for the same month, $23,651,83. It is intended to charge to running expenses everything which does not make a permanent addition to your plant Bearing this in mind, the comparative increase in gross receipts and running expenses between July, 1883, and March, 1884, will, we believe, be regarded as decidedly favorable. For the quarter ending December 41st, 1883, the gross receipts were $130,457.50; for the quarter ending March 31, 1884, the gross receipts were $133,873.51. Based upon ten months' business, the average receipts per subscriber for exchange rentals is $52.40 per annum, while the gross amount of earnings per subscriber per annum is $60.41.

Respectfully submitted for the directors,

WM. A. INGHAM,
President.

A ballot for directors resulted in the election of the following: Wm. A. Ingham, Chas. J. Glidden, Loren A. Downs, A. A. Coburn, Francis Jewett, Chas. E. Adams and A. C. Russell, of Lowell, Mass.; Wesley A. Gove, of East Boston; and W. J. McKinnie, of Cleveland, Ohio.

Chas. J. Glidden was elected secretary and treasurer.

The annual meeting of the directors was held after the adjournment of stockholders, and Wm. A. Ingham was elected president. Wm. A. Ingham, Chas. J. Glidden and Loren N. Downs were elected Executive Committee. Loren N. Downs was appointed general manager, and Wm. H. Bent, attorney.

Canadian Telephone News.

The telephone is now in full operation at Huntington. It is contemplated to extend it to Dewittville and Ormiston, if adequate substantial aid is given by the residents of these two places. There is a report of its extension to Hemmingford. To be a general benefit, however, it must reach Montreal, the market town of that district.

Mr. C. F. Sise, vice-president and managing director of the Bell Telephone Company, and L. B. McFarlane, manager of the eastern division, have recently been spending a few days in the city of St. John, N. B. Their visit there has been of special interest to Mr. J. H. Wagstaff, who has for only a short time been agent for the company, and who, by close attention to business, both in the interest of the company and the subscribers, has so improved the agency as to win the confidence of the managers, and has been rewarded by the appointment to the position of district superintendent, which covers the management and inspection of the Maritime Provinces, with the head office at St. John. Mr. Wagstaff will continue to control the affairs of the St. John agency. The advance has been earned within ten months and without any previous experience in the business, and is, therefore, more to be valued. The company will shortly remove to new offices in the Bostwick building, which are being specially fitted up for them, and, when finished, will be very complete and comfortable.

The Bell Telephone Company are busy stringing in Montreal a superior new steel No. 12 wire.

The Bell Telephone Company exchange office at Toronto, which occupies the southern wing of the *Mail* building, was burned out on the morning of the 24th May. The Bell Telephone Company employs about eighteen young women to answer calls and make telephone connections, six of whom were on duty at the time of the outbreak, their names being Miss Clarke, Miss Mackenzie, Miss Murphy, Miss Leitch, Miss Porter, and Miss McCarthy. Naturally they were very much alarmed at seeing the smoke, and did not care to leave the office Had they done so, and passed by the elevator to the iron doors leading to the composing room, which were closed but not locked, they could easily have escaped by the north stairs without going through the experience which they afterwards met with. Mr. Hambly, of *The Mail* editorial staff, re-entering his room, found the telephone girls at the windows of their office, which overlooks his, but one floor higher up. They called to him for help, and he begged of them to keep calm and he would get assistance. Some of them were preparing to take a jump diagonally to the roof of the while building adjoining *The Mail* building, and knowing the terrible risk they ran, for if they had missed the roof they would have fallen the distance of 100 feet, Mr. Hambly urged them not to do it. One of them, Miss McCarthy, made the leap, and by clutching at a batch of wires and sliding along them, reached the roof in safety. The other girls then went to the windows overlooking King Street, and screamed for help. Mr. F. Thompson, of *The Mail* business department, got a ladder on the roof of the white building, and rearing it against the parapet of *The Mail* building, the girls were enabled to creep along one by one, and passed into safety. The men were only just in time in doing this, as the girls had become terribly excited, and one of them was preparing to jump into King Street, which, had she done, she would have met with certain destruction. The reaction on her was such that when she got down in safety, she immediately fainted. The Bell Telephone Company suffered the most, and their hundreds of subscribers will be put to some little inconvenience for the next few days. It is expected the two hundred wires are now in working order again, the men working day and night to make the connections under the energetic direction of Supt. Neilson.—*Canadian Electrical News.*

.... The Baltimore and Ohio Telegraph Company has reduced the rates from Chicago and St. Louis to New York, Philadelphia, Baltimore and Washington to 40 cents a message.

TELEGRAPHIC

.... The Dacia, Captain W. A. Tindall, left the River Thames on the 21st ult., *en route* for Pernambuco, with a cargo of some 480 miles of telegraph cable, made at the Silverton Telegraph Works for the Western Brazilian Telegraph Company. Part of this cable, we hear, will be laid by the Dacia, the rest being transferred to the steamship Norseman and steamship Viking, the repairing vessels of the Western Brazilian Company.

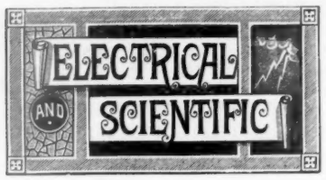
.... At the annual meeting of the stockholders of the Franklin Telegraph Company, held at the office of the Western Union Telegraph Company, Wednesday last, the following-named directors were chosen for the ensuing year: Charles A. Tinker, Norvin Green, Thomas T. Eckert, John Van Horne, A. R. Brewer, Jay Gould, Frederick L. Ames, Jos. F. Greenough, and Thomas Roche. R. H. Rochester was elected treasurer, and Thomas Roche clerk.

.... A movement is on foot in England to employ the blind as telegraph operators. An exchange says: "It is probable that the blind would be much quicker and more accurate readers than persons who have sight; and as blind persons can now be taught to write plainly, easily and quickly, it is probable that they might be utilized as telegraphists, both in reading and writing messages. Certainly they could read to a clerk who wrote from their dictation, and thus be of great assistance."

.... The annual election of the Mexican Telegraph Company was held in this city on Wednesday. The net revenue to December 31, 1883, was $132,850.10, from which there should be deducted for dividends and Mexican Government participation $60,702.30, leaving a surplus December 31, 1883, of $72,157.80. The earnings from January 1 to June 30, 1884 (June being estimated), were $118.456; operating expenses, $30,000; estimated surplus July 1, $160,613.80. Providing for a dividend payable in August of $57,376, the balance, $103,237.80, being carried to reserve. The company has no debt.

.... If Senator Hoar is successful in getting favorable congressional action on the bill that he has introduced into the Senate, appropriating $40,000 for a telegraph cable between Cape Cod and Nantucket, no one will rejoice more heartily than the permanent and summer residents of Martha's Vineyard, for, with a cable connecting the two points named, nothing would be easier than to stretch another cable between Nantucket and the Vineyard. By this means a permanent, though roundabout, communication could be kept up with the mainland. This is now impossible, because of the inability to maintain a cable across the sound, between the Vineyard and Woods Holl, that will work longer than a few weeks at a time. The Western Union will relay this cable, however, for the present season.

.... In Great Britain a telegram of twenty words, with the address, can be sent to any part of the kingdom for one shilling—about twenty-five cents of our money. On the Continent, where the Governments have control of the telegraph, the rates are much cheaper. In Belgium and Switzerland, for instance, there are half-franc telegrams—that is, something less than ten cents of our money; while in Paris the telegraph system is supplemented by pneumatic tubes, carrying post-cards for half a franc. The English Government paid £10,000,000 for what was worth commercially not more than £7,000,000; yet so great has been the increase of business, due to Government control, that the shilling rate is soon to be reduced. The address will, as heretofore, be free; twelve cents will be charged for six words, eighteen cents for twelve words, and twenty-five cents (as now) for twenty words.



* * It is gratifying to learn that the electrical railway at Portrush, Ireland, has proved both a scientific and financial success. The introduction of a similar mode of transit at some of our watering places would no doubt receive ample patronage to far more than cover the original cost of working expenses during the Summer months.

* * Mr. Alan A. Campbell Swinton says it is better and cheaper to light small towns by means of electricity than by a coal-gas system. He compares the equal illuminating effects of gas and electricity in portions of the British Museum, and finds that while the former is estimated to cost $4.22 an hour, the latter has actually cost $1.44 an hour for a total of 18,800 candle-power, using the pendulum arc lamps.

* * A statement comes from Chicago that the Atwater electric car and motor has been exhibited there, running on a track with a 24-cell battery of zinc and carbon elements The claim made for this motor is that it requires only a tenth of the electric current heretofore used by electric motors, on account of increased leverage over load. It would be interesting to know a little more about this motor.

* * The Frankfort-Offenbach Electric Railway appears to be very successful. The length of line is two miles. From the central station the electric current is carried overhead at a height of five to six metres by two cables running parallel. The conductor of the carriage makes the connection by a mechanical appliance. The electric power is sufficient to set two to three carriages, with 25 persons each, in motion at a speed of nine miles per hour.

* * M. G. A. Hirn, the well-known French astronomer, has devised an apparatus for giving the absolute actinic power of the sun. It consists of an alembic of copper containing sulphuric ether, alcohol, or sulphuret of carbon, and exposed to the solar rays. The dimensions are so chosen that the quantity of heat received in unit time is proportional to the quantity of liquid volatilized and condensed by the alembic. By means of Regnault's formulæ the solar heat absorbed by the known surface is calculated from the quantity of liquid condensed.

* * Dr. G. Gore, F. R S., recently announced to the Royal Society that he had found that on passing an undivided electric current through a series of portions of the same metallic solution, that cathodes composed of different metals of equal amounts of immersed surface, required currents of different degrees of density to cause deposits of the same metal upon them, and that the differences in some cases were considerable. Another singular circumstance was also observed, viz., that the cathode which most readily received a deposit was frequently the one composed of the same kind of metal as that which was being deposited.

* * Scarcely twenty-five years ago the most powerful piece of artillery was a 68-pounder, throwing its projectile with a velocity of 1,600 feet per second. Now the weights of guns have been increased from five tons to 100 tons, the velocities from 1,600 feet to 20,000 feet per second, the energies from 1,000 foot-tons to over 52,000, and the projectiles from sixty-eight pounds to 2,000 pounds. But enormous as these attainments are expressed in figures, the highest or greatest are as nothing when compared, as some one has remarked, with those of the projectiles, velocities, and energies existing in nature. Basing the estimate on the principles laid down by Helmholtz, if the earth, for example, be considered as a huge projectile, and if it could be possible to utilize the whole of the energy stored up in gunpowder, there would be required a charge 150 times greater than its own weight and 900 times greater than its own volume to impart her orbital motion to the earth.

The Electric Launch—Advantages and Disadvantages.

Mr. A. F. Yarrow recently read before the British Institution of Naval Architects an interesting description of the electrical launch which was built last year by his firm, in conjunction with the Electric Storage Company and Messrs Samuda Brothers. He said that the launch was propelled by a current obtained from storage cells; and that if a primary battery could be introduced suitable for such propulsion, it would be an evident advantage, avoiding the difficulties and delays incident to the charging process. From his own experience, he was satisfied that of the power required to charge the cells at the works, compared with the ultimate power given off to drive the launch under ordinary working conditions, a return of 45 to 50 per cent. might certainly be relied on. The process of charging occupied in time 25 per cent. longer than the giving-off; that is, if the boat was intended to run six hours, the charging should be estimated to occupy 7½ hours. It could be done faster, but with greater loss of power. Leakage of electricity was estimated to vary from 2 to 10 per cent. per day; but it depended upon the degree of insulation. His experience was that if the accumulators were charged on a certain day, the boat would be available for use any day of the following week. Consequently, as the vessel was ready for use at any time, it might be compared to a yacht with steam always up. In the one case, however, a man would have to be in constant attendance, while in the other this was unnecessary. Comparing the electrical launch with a steam launch, the mean speed of the latter, if of corresponding construction, would have been from 1½ to 2 miles an hour faster than the electrical, which made eight statute miles; but in salt water, where the steamer would have had to carry fresh water and fuel, this advantage would be reduced. The entire management of the electrical launch was within the control of one man. Difficulties which were experienced in the instance under review would, he averred, vanish on better acquaintance with the subject; and he would not give figures as to the cost of working, because, at the present stage of development, these would be unreliable. In the hands of those who thoroughly understood them, the wear and tear of accumulators would, he believed, be by no means excessive or prohibitory; but they might be spoilt in a few minutes by neglect or inexperience. As for the direction in which to look for improvements, he suggested that attention should be devoted to reduction of weight; and inasmuch as the insulating silk or cotton ran risk of destruction by the heat of the passing current, he thought that if asbestos or some such non conductor capable of resisting high temperature were used, a more powerful current could be employed, and greater power developed from a given weight of machine. Comparing the electrical system with steam, the advantages in favor of the former might be stated briefly as follows: (1) entire absence of noise; (2) great cleanliness; (3) the whole of the boat being available for passenger accommodation, the midship, or best part of it, not being occupied by machinery; (4) when once charged it is ready for use at a moment's notice. The points against it were: (1) difficulty and delay in frequent charging; (2) greater first cost; (3) greater cost of working where an engine has to be specially laid down for the purpose of charging. Where the above objections existed to a minimum and the advantages to a maximum extent, the electrical system, even in its present stage of development, seemed to be quite available; for example, when a natural source of power existed (such as a fall of water, a dynamo might be easily driven at a nominal cost to charge the cells. If wished, this could be done at night, and the boat would be available during the day. Under such conditions the electrical system would, he believed, have a balance of advantages in its favor. Electrical boats would be found useful for various purposes, such as pleasure yachts. Fitted up as torpedo boats for night attack, being perfectly noiseless and without funnel or fire to betray their existence, they seemed to be eminently suitable.

The Electric World.

A FRENCHMAN'S DREAM OF ELECTRICITY ABOLISHING NIGHT.

La Vie Moderne amuses its readers with one of those visions of the future which have been in vogue since science began to astonish the present age with its marvelous performances. This time it is electricity which furnishes the substance of the dream. The coal mines were giving out, and their use was almost discontinued except for manufacturers; gas had become extraordinarily dear. To take its place in Paris, an American—it is always the Americans now who do wonderful as well as eccentric things in France—had conceived the project of erecting a tower 350 meters high on the open space in front of Notre Dame, for whose summit an enormous nickel-plated reflector 187 meters in circumference should shed down a flood of light over all Paris that would simply abolish night. On the top of the column a dynamo was to be required merely to keep the gigantic carbons at due distance from one another; at the base in great cellars were 2,000 elements, each couple of which was to absorb daily four tons of water and 1,200 kilograms of acid.

In six months it was done, and Paris awaited the first lighting with an interest brightened by the news that three men, who, during one of the experiments, had been in the focus, had been melted and evaporated, and the American chief engineer, M. Attison, who was taking a spectroscopic observation, had been fortunate enough to note the lines of the human spectrum—or spectre. Their expectations were not disappointed. A flood of light poured over the city, and (unlike, we must say, any electric light which we Americans have succeeded in producing in our country) it turned round corners, entered the houses, went up stairs and lighted not merely the parlors, but the passageways.

But now came a difficulty. Paris always keeps late hours, but it ends by going to bed; those who amuse themselves moderately seek home at midnight; those who try hard to enjoy life leave off at three or four at latest. But why leave off at all in broad daylight, or perhaps we should say, in broad nightlight? And how could one sleep without darkness? For a few days Paris was perplexed. It lost its reckoning of time entirely, and at last it was found necessary to fire a morning and evening gun in every arrondissement to let the people know when the change was made from artificial to natural, and from natural to artificial sun. The new light cost for the city less than half as much as all the private lights which it displaced. Of course, gas stocks went down, down, lower than Union Pacific has been going here the last two weeks. Mme. Mackay, unwilling to have anything so cheap in the house, threw all her shares into the fire. Many persons were ruined, but more gained by being relieved from the cost of lighting, "and the Lutetian race, constantly bathed in living light, acquired a force, a beauty, an energy worthy of the Homeric ages."

On the Most Economical Size of Electrical Conductors.

The problem of determining the most economical size of a conductor designed to transmit electrical energy for lighting, or as a source of power, is one of great importance, and not difficult of solution.

Let E represent the difference of potential between the terminals of the main conductor at the dynamo, R the resistance of the conductor, r the combined resistance of the lamps, and C the total current; then by Ohm's law

$$E = C(R + r)$$

If H. P. represent the energy of the current measured in horse-power, then

$$\text{H. P.} = \frac{C\,E}{745} = \frac{C^2(R + r)}{745}$$

The resistance is here composed of two parts; and since the heating effect of the current, or the loss of electrical energy, in various part of the circuit varies directly with the resistance, the horse-power wasted upon the conductor is evidently expressed by the equation—

$$\text{H. P.} = \frac{C^2 R}{745} \qquad (1)$$

Let p be the cost of an electrical horse-power transmitted to the conductor for one hour, and n the number of hours in a year that the current is used; then the cost of the current wasted in the conductor during the year will be

$$\text{Loss per year} = p\,n\,\text{H. P.}$$

Substituting value of H. P. in (1)

$$\text{Loss per year} = \frac{p\,n\,C^2\,R}{745} \qquad (2)$$

Let R_{sp} be the specific resistance (the resistance of unit length of unit cross section) of the material composing the conductor, l its length, and d its diameter, if round; then the area of cross section of the conductor will be expressed by

$$\square = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$$

The total resistance of the conductor will be

$$R = \frac{R_{sp}\,l}{\frac{\pi d^2}{4}} = \frac{4\,l\,R_{sp}}{\pi d^2} \qquad (3)$$

Substituting this value in (2), we have

$$\text{Loss per year} = \frac{p\,n\,C^2\,4\,l\,R_{sp}}{745\,\pi\,d^2} \qquad (4)$$

Let W represent the weight of unit length of unit cross section of the conductor; then

$$\text{Weight of conductor} = \frac{W\,L\,\pi d^2}{4} \qquad (5)$$

If the cost of unit weight, *in situ*, be g, then

$$\text{Cost of conductor} = \frac{g\,W\,l\,\pi\,d^2}{4} \qquad (6)$$

Let i be the current rate of interest, then

$$\text{Interest on cost of conductor} = \frac{i\,g\,W\,l\,\pi\,d^2}{4} \qquad (7)$$

Now, the cost of the conductor, and consequently the interest on that amount, may be supposed to vary directly with its area of cross section, but the resistance of the conductor, and therefore the loss of energy in it will vary inversely with its cross section. Hence the interest on the cost of the conductor and the cost of the current wasted in a year will vary inversely with each other. Now, the sum of two quantities which vary inversely is a minimum when the two quantities are equal.

The most economical size will, therefore, be that with which the cost of current wasted in a year will equal the interest on capital invested in conductor. Hence

$$\frac{4\,p\,n\,C^2\,l\,R_{sp}}{745\,\pi\,d^2} = \frac{i\,g\,W\,l\,\pi\,d^2}{4} \qquad (8)$$

$$d^4 = \frac{16\,p\,n\,C^2\,R_{sp}}{745\,\pi^2\,i\,g\,W} \qquad (9)$$

It will be noticed that l cancels from equation (8); therefore the size of conductor is independent of its length.

EXAMPLE.

Let p ..... = 0.3
" $n = 365 \times 6$ ..... = 2190 hours
" C ..... = 1000 amperes
" R_{sp} pure copper, inch, at 0° C. ... = .00000064645 ohms
" i ..... = 8 per cent.
" g per lb. *in situ* ... = 30
" W cubic inch..... = .32523 lbs.

Log. 745	=	2.872156	
" π^2	=	0.994302	
" .08	=	2.903090	
" .30	=	1.477121	
" .32523	=	1.512192	
		1.758861	
Log. 16.	=	1.204120	
" .03	=	2.477121	
" 2190.	=	3.340444	
" 1000000.	=	6.	
" .00000064645	=	7.810638	
		2.831223	
		1.758861	
		4)1.072362	
Log. d	=	.268090	

$d = 1.8539$ in.

From equation (9) it appears that the area of cross section varies with the current; hence a copper conductor that carries 10 amperes, under the conditions in the above example, should have a diameter of

$$\frac{1.8539}{\sqrt{\frac{1000}{10}}} = .18539 \text{ in. (nearly No. 5 gauge).}$$

It is important now to consider the heat generated in the conductor by the current. The heat in water gramme centigrade degrees generated by any current in t seconds is expressed by the equation:

$$H = .24\ C^2\ R\ t \qquad (10)$$

The ratio between the gramme centigrade and pound Fahrenheit degrees is

$$\frac{9}{5 \times 453.54}$$

which, multiplied by .24, gives .00095251. Hence the heat in pound Fahrenheit units will be

$$H = .00095251\ C^2\ R\ t \qquad (11)$$

Substituting for R its value in (3)

$$H = .00095251\ C^2\ t\ \frac{4\ l\ R^{sp}}{\pi\ d^2} \qquad (12)$$

The temperature to which the conductor will be raised in any time, supposing no heat is radiated or conducted away, will be the quotient of the whole amount of heat divided by the weight of the conductor multiplied by the specific heat, H^{sp}, of the material composing it.

$$T = \frac{H}{\text{weight} \times H^{sp}}$$

Substituting for weight its value in (5)

$$T = \frac{4\ H}{W\ l\ \pi\ d^2\ H^{sp}} \qquad (13)$$

Finally substituting for H its value in (12)

$$T = .00095251 \times 16 \frac{C^2\ t\ R^{sp}}{W\ \pi^2\ d^4\ H^{sp}} \qquad (14)$$

Since, in the above equation, C^2 and d^4 are the only variables, T is constant, under the same conditions, for wires of different sizes each carrying its most economical current.

EXAMPLE.

The copper wire in the last example with current of 1,000 amperes, t one hour or 3,600 seconds, H^{sp} of copper .09515.

Log.	.32523	=	1.512192		
"	π^2	=	0.994302		
"	d^4	=	1.072392		
"	.09515	=	2.978409		
				0.357265	
					T = 9° 8302 Fah.

Log.	.00095251	=	4.978869		
"	16.	=	1.204120		
"	1000000.	=	6.		
"	3600.	=	3.556303		
"	.0000061645	=	7.810568		
				1.549830	
				.557265	
Log. T....		=		.992565	

In the above example it is assumed, as has been before stated, that no heat is lost by radiation or conduction. But it is evident a conductor whose temperature rises only at the rate of about 10° Fahrenheit per hour would soon reach a point where the heat given off would equal that acquired; hence it could never become many degrees hotter than surrounding objects, especially if Prof. Forbes' suggestion of making the conductor flat was adopted.

I have no data for computing what this final difference of temperature would be for a wire buried in the ground (the only way to dispose of conductors carrying large currents), and it would evidently vary in different localities, but it is safe to assume that the difference would be so small that it would only be objectionable by slightly increasing the resistance of the conductor.

W. L. HOOPER.

Physical Laboratory, Tufts College, May 7th, 1884.

Postal and Bankers and Merchants' Companies Allied.

THEIR BUSINESS TO BE POOLED—TWELVE THOUSAND MILES OF POLE LINE AND SEVENTY-SIX THOUSAND OF WIRE.

Negotiations have been in progress for several days between Henry Cummins, 2d vice-president and general manager of the Postal Telegraph and Cable Company, and G. S. Mott, president and general manager of the Bankers and Merchants' Telegraph Company, for an alliance whereby the two companies could be operated together. On Friday of last week the Executive Committees of the companies agreed upon a contract, and the Boards of Directors approved it.

Mr. Cummins says that the companies would do business in common, but the organizations would be kept separate. Mr. Mott would be the general manager of both companies. The contract was in the nature of a pooling arrangement, running for twenty-five years from June 7. The earnings and expenses would be divided. Where both companies covered the same points, the division of business would be by percentages. The expenses of both organizations, Mr. Cummins added, would be greatly reduced by the arrangement. Their offices would be together at all points. Mr. Cummins then made the following statement of the extent and plans of the allied systems:

"The union of these two companies brings under one control about 9,000 miles of pole lines, with about 55,000 miles of wire now completed and in operation, and there will soon be completed 3,000 miles more of pole line and 21,000 miles additional wire, making a total of 12,000 miles of pole line and 76,000 miles of wire. The united companies will have under this arrangement three lines between New York and Boston; three lines between New York, Philadelphia, Baltimore and Washington; three lines between New York and Chicago; two lines between Chicago and St. Louis; one line from Chicago to St. Paul and Minneapolis; one line from St. Louis to Kansas City and Omaha; a main line from Washington to New Orleans, through Richmond, Augusta, Atlanta and Montgomery, and also a line extending from Richmond to Norfolk, and from Columbus to Charleston, and from Augusta to Savannah; and a second line to Atlanta by way of Cincinnati, Louisville, Nashville and Chattanooga.

"One Chicago line runs direct by way of Binghamton, Elmira and Cleveland; another by way of Albany, Utica, Syracuse, Rochester, Buffalo and Toledo; another by way of Pittsburgh, Columbus, Cincinnati and Terre Haute. There are two lines between Buffalo and Pittsburgh, through the oil regions; two lines to Toledo from the main Chicago lines, and a line to Detroit.

"One line to Boston is by way of New Haven and Providence; another by way of Hartford, and another by way of Albany and Springfield. There is also a second line from Richmond by way of Lynchburg to Augusta, and a large number of local lines in Pennsylvania, New York, Massachusetts and other localities.

"This combination also includes a complete stock quotation or ticket system (the Commercial) now in operation in this city and Philadelphia, and also soon to be started in Chicago and other cities; also the McTighe automatic telephone switch-board, and other telephone apparatus, on which they are trying to build a system. The whole forms a complete system of land lines and necessary adjuncts, which will be operated in connection with the Bennett-Mackay ocean cables.

"In this arrangement between the two companies, neither assumes or becomes responsible for the fixed liabilities of the other, but their joint control and management will be composed of the best talent and the financial strength of both companies. The expense of operating will be reduced as nearly as possible to the cost of running one company, while the business will be extended to the fullest capacity of the united lines, and run with the greatest possible economy. And, inasmuch as these lines reach at least 80 per cent. of all the paying telegraph business of the country, and are allied with the great Atlantic cable system of the Commercial Cable Company, having connections throughout Europe, they cannot fail to be maintained on a dividend-paying basis.

"It is the purpose of the united company to secure to the country cheap and reliable telegraphy, and to relieve the public from the present onerous and exorbitant charges now incurred upon telegraphic, telephonic and quotation business."

The Executive Committees of the two companies will form a joint committee for their united management. E. Burton Hart, John Anderson and Franklin Edwards have entered the Bankers and Merchants' Board to represent the Postal. They took the places of W. W. Maris, George Putnam Smith and S. D. Houston. In addition, A. W. Dimock, G. S. Mott, the president, and J. G. Case, the treasurer of the Bankers and Merchants' Company, will represent in that Board the Postal Company's interests. That gives the Postal a representation of six out of nine directors. The Bankers and Merchants' controls the American Rapid and Southern Telegraph companies, which will be operated with the others.

The Postal Company's Board of Directors is composed of sixteen members. There is a vacancy in it, which will be filled by the election of Mr. Mott. Where the Bankers and Merchants' lines, now in course of construction, duplicate the lines of the Postal Company they will be abandoned, although the general work of construction of both companies will be kept up. The line of the Bankers and Merchants' projected to Quebec will be stopped at Niagara Falls for the present. John W. Mackay, the president of the Postal Company, who is in California, has been kept apprised of the negotiations, and he has approved of the pooling agreed upon.

The State of Manufacturing.

Visits during the first half of May to the manufacturing towns in four counties of Connecticut show a condition of business activity much more favorable than the general reports in the newspapers, taken from all parts of the country, would seem to justify. Perhaps much of this difference is to be attributed to the varied character of the industries in those portions of the one State visited. Machine tools, guns, sewing machines, machine screws, bicycles, small tools, builders' hardware, bench hardware, nuts and bolts, screw taps and dies, butt hinges, pumps, drop and lever presses, steam, water, and gas fittings, and many other branches of productive work of which the general public are in continual need are in the usual demand. In no one department of productive industry is there evidence of a permanent falling off in demand, although there is a tendency to crowd down the prices. So, on the other hand, there is no unusual demand for the productions of any department. In some instances the hours of labor have been temporarily shortened; in others (two) the number of men has been curtailed. But in the first instance a return to the original full time is shortly expected, and in the other the men were discharged because of a glut in the specialties which they produced. One establishment that in early spring shortened its hours of labor, is now working overtime in its most important departments.

Some annoyance has been caused by the debates and delays in Congress on the matter of a tariff on foreign productions as affecting home manufactures, and some of the manufacturers attribute the falling off of orders to the uncertainty which this state of Congressional business produced. But there is a better feeling than there was during the pending and threatening of the Morrison bill, and it seems possible that the old notion of a presidential election year proving to be one of general business depression may be shown to be unfounded.—*Scientific American.*

It is stated that on the Pennsylvania Railway the average consumption of fuel for all passenger trains is fifty-six pounds per train mile.

ELECTRIC LIGHT NEWS

—— The flour mills of Messrs. W. and J. Bairstow, of Keighley, England, have been fitted with the electric light to prevent the possibility of fire. The installation consists of one Crompton-Burgin dynamo machine of the self-regulating type, and sixty-two 20 candle-power 110 volts, which light the mill, boiler and engine-houses, and offices.

—— The peculiarity of the Cruto incandescent lamp is that the carbon is deposited upon a very slender filament of platinum, serving first as a core and ultimately forming a compound possessing the endurance of the carbon and the conductivity of the platinum. Selected Cruto lamps are said to have given 17-candle power with an expenditure of only 32 volt-amperes, while not less than 60 volt-amperes are required for most other 16 to 20 candle power lamps.

—— Hitherto it has been the practice to examine the interior of newly made plumbago crucibles by the aid of a gas flame, in order to discover any flaws there may be in the material; but the use of a gas flame for such work is both clumsy and disagreeable, owing to its flaring nature, and the heat and fumes which arise from it, and blow into the faces of the workmen. An incandescent lamp, fitted with a small reflector behind, will take the place of the gas jet with the advantage of clearness, coolness and convenience. It can be inserted into the inside of the crucible, and the internal surface examined at leisure.

—— The Bridgeport Electric Light Company was formed to use the Thomson-Houston Company system of arc lights, and have about seventy in operation. They use a Lowe & Watson boiler, and two 50-H. P. Armington & Sims engines, but have decided to change their boiler, and have ordered a 100 horse-power tubular boiler made by the Pacific Iron Works, of Bridgeport, and they have contracted with the Jarvis Engineering Company, of Boston, to set this boiler with the Jarvis Patent Furnace, to burn cheap fuel, as they found it cost them as much for fuel to run 50 lights with their present boiler as it did the New Haven Electric Light Company to run 100 lights with a boiler set with the Jarvis furnace.

—— *Engineering* reports that a most satisfactory and successful electric light installation has just been completed at the Park Pit, Ocean Collieries, South Wales. The motive power is a 6 horse-power Marshall engine, fitted with Hartnell's patent automatic expansion gear, driving a Crompton-Burgen self-regulating dynamo, the lighting being effected by fifty 20 candle-power Swan lamps, distributed underground and on the surface over the screens, workshops, and engine-houses. The novel feature in the installation, however, is the very successful manner in which the bottom of the pit is lighted for a distance extending 150 yards into the workings to the main engine roads.

—— At a ball recently given in London by Lady Cooper, an illustration was given of the ease with which electricity may be utilized in a ball-room with comparatively little trouble and absolute certainty. More than 120 incandescent lamps were employed. They were fed from Faure-Sellon-Volckmar electrical accumulator cells, which had been brought in a couple of vans, and were stationed in the coach-house at the back of the mansion. The accumulators were connected with insulated wires which had been temporarily arranged in the interior. The effect when the lamps were lighted was very pleasing, the temperature of the rooms was not raised to any appreciable extent, and the result of the light on colors and complexions was most agreeable. The electricity was generated at the works of the Electrical Power Storage Company, Milwall, and was conveyed from a distance of about ten miles.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 3, 1884.

299,546 Electric fire-alarm; George E. Hovenden and Edwin R. Hovenden, Grand Rapids, Mich.

299,551 Magneto-electric machine; Henry Francis Joel, London, England.

299,552 Electro-magnetic indicator; Warren Seymour Johnson, Whitewater, assignor of one-half to William Plankinton, Milwaukee, Wis.

299,561 Method of and apparatus for individualizing telephone time signals; Henry B Lytle and John J. Carty, Boston, Mass.

299,562 Telephone time-signal apparatus; Henry B. Lytle and John J. Carty, Boston, Mass.

299,600 Electric arc lamp; Thomas G. Turner, New York, N. Y., assignor by mesne assignments to H. A. Seymour, Washington, D. C.

299,603 Metallic circuit for telephone exchanges; James C. Warner and Ernest P. Warner, Chicago, Ill., assignors to the Western Electric Company, same place.

299,664 Printing telegraph; William J. McCausland, Philadelphia, Pa., assignor to William W. Kurtz, same place.

299,708 Electric lamp; Alexander Welsh, St. Denis, Md., assignor to the Viaduct Manufacturing Company, of Baltimore, Md.

299,709 Electric lamp; Alexander Welsh, St. Denis, Md., assignor to the Viaduct Manufacturing Company, of Baltimore, Md.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

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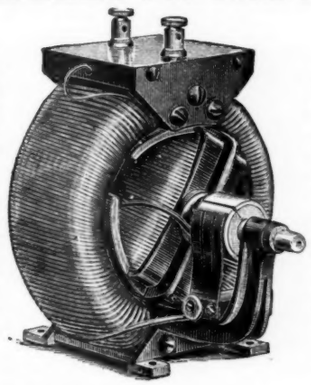

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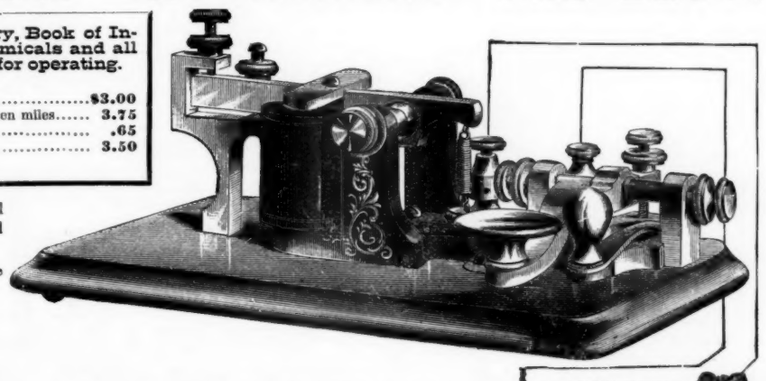

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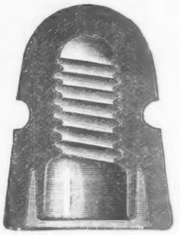

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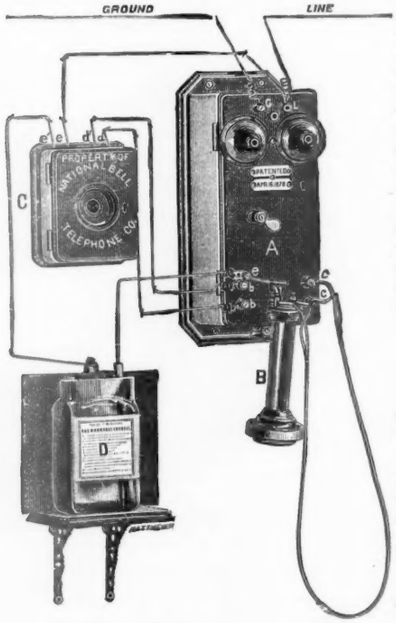

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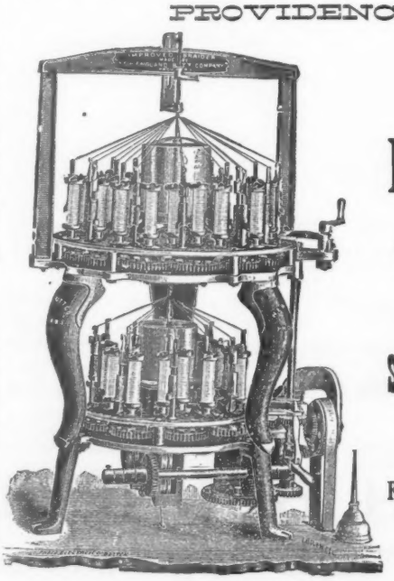

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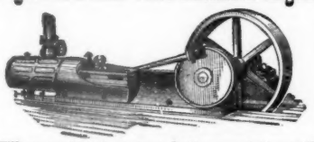

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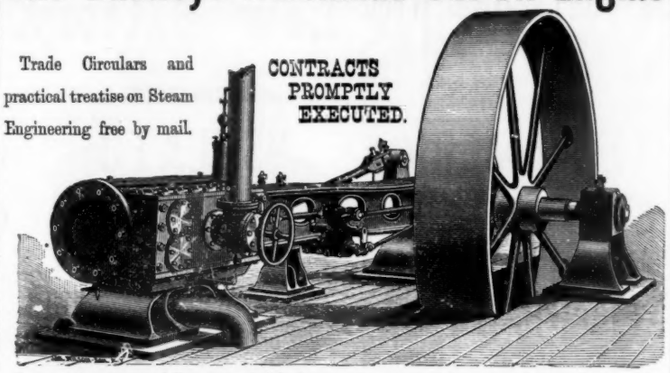

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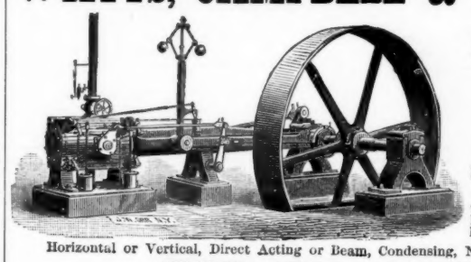

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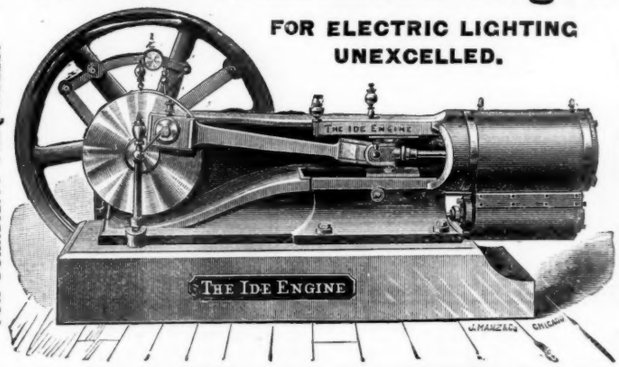

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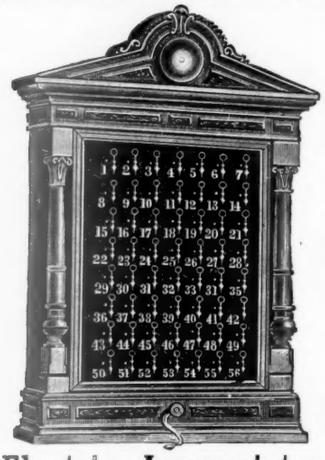

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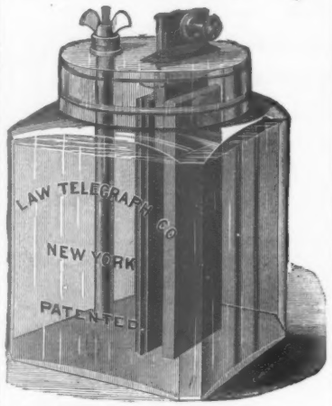

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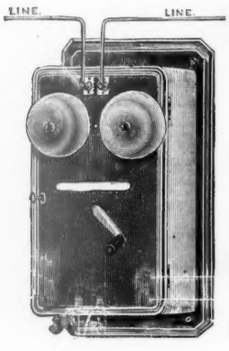

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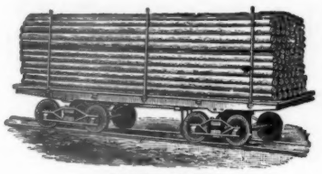

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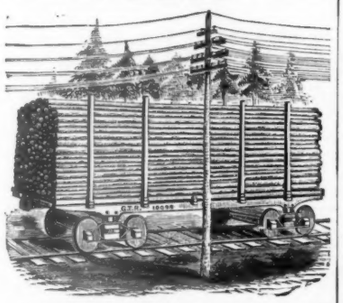

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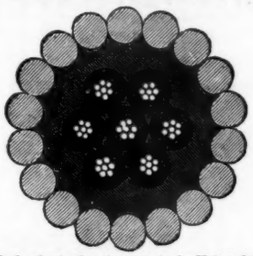

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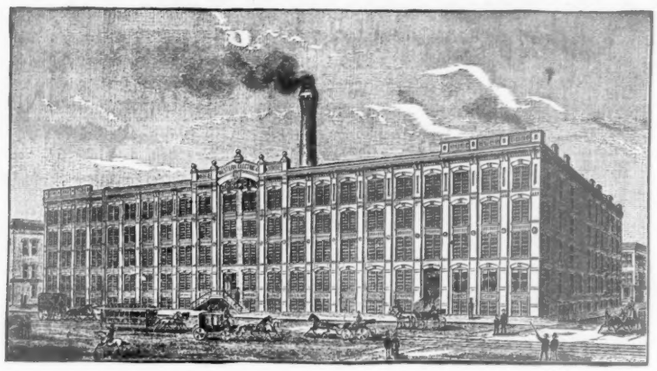

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